

TSUNAMI NEWSLETTER

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**INTERNATIONAL
TSUNAMI
INFORMATION
CENTER**



**INTERGOVERNMENTAL
OCEANOGRAPHIC
COMMISSION - UNESCO**

INTERNATIONAL TSUNAMI INFORMATION CENTER

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Director

TSUNAMI NEWSLETTER is published by the International Tsunami Information Center to bring news and information to scientists, engineers, educators, community protection agencies and governments throughout the world.

We welcome contributions from our readers.

The International Tsunami Information Center is maintained by the U.S. National Oceanic and Atmospheric Administration for the Intergovernmental Oceanographic Commission of the United Nations Educational, Scientific and Cultural Organization. The Center's mission is to mitigate the effects of tsunamis throughout the Pacific.

MEMBER STATES

Present membership of the International Coordination Group for the Tsunami Warning System in the Pacific comprises of the following States:

CANADA
CHILE
CHINA
COLOMBIA
COOK ISLANDS
ECUADOR
FIJI
FRANCE
GUATEMALA
INDONESIA
JAPAN
KOREA (REPUBLIC OF)
MEXICO
NEW ZEALAND
PERU
PHILIPPINES
SINGAPORE
THAILAND
UNITED KINGDOM (HONG KONG)
USA
USSR
WESTERN SAMOA

TABLE OF CONTENTS

	<u>Page</u>
<u>NEWS EVENTS</u>	1
International Union of Geodesy & Geophysics (IUGG) Tsunami Symposium	1
Iran Earthquakes, June - July 1981	10
Pagan Volcano Erupted	10
Southwest Pacific Earthquakes, 6-15 July 1981	11
Small Tsunami Generated by the Earthquake in Greece on 4 March 1981.	11
Tsunami in South Africa	11
<u>UNESCO - IOC - ITSU</u>	12
Tenth Session of the Working Committee on International Oceanographic Data Exchange Held	12
New Member State of IOC	12
Dr. Iouri Oliounine Assumes Responsibility for ITSU Matters	12
European Conferences on Earthquake Hazard	12
<u>INTERNATIONAL TSUNAMI INFORMATION CENTER - HONOLULU</u>	13
Director of ITIC Participates in the 1981 IUGG Tsunami Symposium . .	13
Chairman of ITSU Visits ITIC	13
Administrator of Philippine Civil Defense Visits ITIC	13
Vice-Chairman of ITSU Visits ITIC	14
Visitors to ITIC	14
ITIC Informational Services	14
ITIC Resumes Work on Tsunami Bibliography	15
Tsunami Exercise	15
<u>NATIONAL AND AREA REPORTS</u>	16
New President for the Colombian Commission of Oceanography	16
GOES Tsunami Platforms Installed	16
Change to Communication Plan for Tsunami Warning System	18
Tsunami Station Inspection	18
<u>ANNOUNCEMENTS</u>	18
Tsunami Data Now Available	18
The Tsunami Society Needs a Logo	19

	<i>Page</i>
Global Digital Seismograph Network	20
International Conference on Coastal Engineering	20
Coastal Structures '83	22
The Law of the Sea Institute - 15th Annual Conference	22
Seventh European Congress on Earthquake Engineering	23
Fourth Conference on Hydrometeorology	23
Tsunami Hazard and Community Preparedness in Alaska	23
Action on Earthquake Preparedness - SCEPP	24
Two Reports on Studies of the Hilo Bay of Hawaii Completed	24
Joint Oceanographic Assembly to be held in Halifax, August 1982	25
Krakatoa Remembered	25
<u>ABSTRACTS AND RESUMES</u>	26
Study on Tsunami Runup and Countermeasure, May 1981	26
A Study on the Force of Ocean Waves Upon a Vertical Breakwater	27
Seasat Detection of Waves, Currents and Inlet Discharge	27
Historical Tsunamis and their Studies	28
On Migration Phenomena of Aftershocks Following Large Thrust Earthquakes in Subduction Zones	29
Tsunamis - Harbor Oscillations Induced by Nonlinear Transient Long Waves	30
An Introduction to Tsunamis and Defense Works in the Sanriku Coastal Area	31
<u>PACIFIC TSUNAMI WARNING CENTER</u>	31
New Geophysicist at PTWC - Richard Sillcox	31
Seismic Summary	32

NEWS EVENTS

International Union of Geodesy and Geophysics (IUGG) Tsunami Symposium

The following is a report of the IUGG Tsunami Symposium held at Sendai, Japan, 25-28 May 1981, by Dr. Harold G. Loomis, Secretary, IUGG Tsunami Commission.

1. *The Tsunami Commission of the IUGG held its traditional mid-assembly Symposium in Japan on May 25-28, 1981. Scientific sessions were held at Sendai, May 25-26, and Ofunato, May 27. The closing ceremonies were held at Kamaishi on May 28. As part of the Symposium there was a bus trip from Sendai to Ofunato and from Ofunato to Kamaishi along coasts frequently hit by large tsunamis. The Symposium, including tours, banquets and cultural events was superbly arranged by the Organizing Committee consisting of Prof. Toshio Iwasaki, chairman and including: Drs. Chiaki Agemori, Koyoshi Horikawa, Masanobu Hosoi, Yuichi Iwagaki, Kinjiro Kajiura, Hisashi Miyoshi, Akira Ozaki, Toru Sawaragi, Nobuo Shuto, Ziro Suzuki, Yoshiaki Toba, Hiroyoshi Togashi, and Hideo Watanabe. Professor Kumiji Iida was Convenor of the Symposium and advisor to the Organizing Committee.*

2. *The participants in the program included scientists and engineers distributed by country as follows: 101 Japanese, 13 Americans, 1 Russian, 3 Canadians, 2 Europeans, 3 Peruvians, 1 Chilean, 1 Mexican, and 1 Thai.*

3. *The programs included sessions on the following topics:*

- A. *Tsunami Source and Earthquake and Warning System*
Chairmen: Dr. W.M. Adams, USA and Dr. Z. Suzuki, Japan
- B. *Tsunami Waves and Spectra*
Chairmen: Dr. S.S. Voyt, USSR and Dr. K. Horikawa, Japan
- BJ. *Tsunami Potential Estimation*
Chairmen: Dr. Li-San Hwang, USA and Dr. H. Watanabe, Japan
- C. *Theoretical Arguments on Tsunami Waves*
Chairmen: Dr. T.S. Murty, Canada and Dr. K. Kajiura, Japan
- D. *Tsunami Generation and Numerical Simulation of Historical Tsunami*
Chairmen: Dr. E. Bernard, USA and Dr. N. Shuto, Japan
- E. *Harbor Oscillations by Long Waves and Tsunamis (1)*
Chairmen: Dr. F. Raichlen, USA and Dr. Y. Iwagaki, Japan
- F. *Tsunami Runup*
Chairmen: Dr. T.Y. Wu, USA and Dr. H. Miyoshi, Japan
- G. *Mitigation of Tsunami Hazards and Socio-economic Effects*
Chairmen: Dr. Philip L.F. Liu, USA and Dr. H. Togashi, Japan

H. Harbor Oscillations by Long Waves and Tsunamis (2)

Chairmen: Mr. G.C. Dohler, Canada and Mr. K. Tanimoto, Japan

I. Historical Study of Tsunamis

Chairmen: Dr. Harold G. Loomis, USA and Dr. Y. Nagata, Japan

The titles of papers and authors are listed in the last part of this report.

4. A meeting of the IUGG Tsunami Commission was held on May 26, 1981.

5. After the Symposium, there was a 3-day tour of the Sanriku coast to observe tsunami wave heights (historical), tsunami defense works, and historical tsunami monuments. Every community had breakwaters and sea walls for tsunami protection. These also included elaborate gates to allow traffic and rivers to pass through, but to be closable quickly to the event of a tsunami.

6. The paper summaries will be published along with the minutes of the IUGG Tsunami Commission meeting. The Organizing Committee will publish a reviewed and edited Proceedings of the meeting.

7. The next Symposium will be held in conjunction with the IUGG General Assembly in Hamburg, August 1983, and the one after that in Sidney, B.C. in August 1985.

The following are authors and titles of papers presented at the Symposium:

Session A - Tsunami Source and Earthquake and Warning System

A-1 Seismic Source Spectrum of Tsunami and Ordinary Earthquake.

M. Takemura and J. Koyama, Tohoku Univ., Japan

A-2 Investigation of Rayleigh Wave Spectra for a Set of Tsunamigenic and Non-tsunamigenic Earthquakes.

V.K. Gusiakov, Computing Centre, Novosibirsk, U.S.S.R.

A-3 Use of Long Period Seismic Waves for Fast Evaluation of Tsunami Potential of Large Earthquakes.

H. Kanamori and J.W. Given, Calif. Inst. Tech., U.S.A.

A-4 A New System for Seismic Observations and Tsunami Warning in the Japan Meteorological Agency.

M. Ichikawa and H. Watanabe, Seismological Div., Japan Meteorological Agency, Japan

A-5 Some Remarks on the Occurrence of Tsunamigenic Earthquakes around the Pacific.

K. Iida, Aichi Inst. Tech., Japan

A-6 Mechanism of Tsunami Earthquakes: Evidence from Tsunami Data.

R.P. Comer, M.I.T., U.S.A.

A-7 A New Scale of Tsunami Magnitude, Mt.

Katsu Abe, Hokkaido Univ., Japan

Session B - Tsunami Waves and Spectra

- B-1 Verification, Calibration and Quality Assurance for Tsunami Models.
V.M. Adams, Univ. Hawaii, U.S.A.
- B-2 Digitization of Tsunamigrams.
S.O. Wigen, Inst. Ocean Sci., Canada
- B-3 Paralogism of the Wave in Lituya Bay.
H. Miyoshi, Tokyo Univ. Fisheries, Japan
- B-4 An Edge Wave Trapped Along a Curved Coast.
Y. Fujinawa, National Res. Center Dis. Prevention, Japan
- B-5 Study of Shelf Effect for Tsunami using Spectral Analysis.
Kun. Abe, Nippon Dental Univ. and H. Ishii, Tohoku Univ., Japan
- B-6 Maximum Entropy Spectral Analysis of Tsunami along the Mexican Coast, 1952-1979.
A.J. Sanchez Es. Inv. Ocenogr. and S.F. Farreras, CICESE, Mexico

Session BJ - Tsunami Potential Estimation

- BJ-1 Susceptibility of Western Australian Coastline to Tsunami Originated South of Indonesia.
H. Allison, CSIRO, Wembley, Australia and S. Nakamura, Kyoto Univ., Japan
- BJ-2 Tectonic, Seismic and Tsunami Energies.
T.S. Murty, Inst. Ocean Sci. Canada
- BJ-3 Certain Concepts in Numerical Data Analysis Applicable to Tsunami Research.
T.S. Murty, Inst. Ocean Sciences, Canada
- BJ-4 Some Statistics Relevant to Tsunami: The Coastal Height Statistics and Correlations of Tsunami and Earthquake Parameters.
K. Kajiura, Univ. Tokyo, Japan
- BJ-5 Parameters of Tsunami Waves in the Source.
N.R. Mirchina, E.N. Pelinovsky and S.Kh Shavratsky, Inst. of Applied Physics, Acad. Sci. U.S.S.R.
- BJ-6 Determining the Generating Region of a Tsunami.
P. Doilibi and R.D. Braddock, Griffith University, Australia

Session C - Theoretical Arguments on Tsunami Waves

- C-1 Focusing and Reflection of a Cylindrical Solitary Wave.
A.T. Chwang and H. Power, Univ. Iowa, U.S.A.
- C-2 Nonlinear and Dispersive Deformation of Tsunami with Typical Initial Profiles on Continental Topographies.
M. Shibata, INA Ltd., Japan

- C-3 On Some Three-Dimensional Aspects of Tsunami Coastal Effects.
H.R. Scember and T.Y. Wu, C.I.T., U.S.A.
- C-4 About the Possible Mechanism of Chilean Tsunami in 1960.
S.S. Voyt, A.N. Lebedve and B.I. Sebekin, Inst. Oceanology, U.S.S.R.
- C-5 Tsunami Generation as Finite Depth Cauchy-Poisson Problem or Long Wave Problem.
T. Ichiye, Texas A&M Univ., U.S.A.
- C-6 The Most Dangerous Tsunami Waveform.
H. Allison, CSIRO, Australia

Session D - Tsunami Generation and Numerical Simulation of Historical Tsunami

- D-1 A Numerical Model for Tsunami Generation and Propagation.
Philip L.F. Liu and J. Erickson, Cornell Univ., U.S.A.
- D-2 Numerical Simulation of Historical Tsunami generated off the Tokai District, Central Japan.
I. Aida, Univ., Tokyo, Japan
- D-3 Finite Element Method for Tsunami Wave Propagation in Tokai District.
K. Iida, Aichi Inst. Tech., T. Suzuki, Chubu Electric Power Co.,
K. Inagaki and K. Hasegawa, Unic Corp., Japan
- D-4 Tsunami Simulation with an Explicit, Variable-grid, Numerical Time-stepping Scheme.
H.G. Loomis, Univ. Hawaii, U.S.A.

Session E - Harbor Oscillations by Long Waves and Tsunamis (1)

- E-1 Tsunami Response of the Tsugaru Straits.
S. Takahashi and I. Yakuwa, Hokkaido Univ., Japan
- E-2 Tsunami Intruding into a Bay in a Scope of Numerical Experiment.
S. Nakamura, Kyoto Univ., Japan
- E-3 A Hybrid Simulation System Developed for Model Tests of Tsunami in a Harbor.
T. Iwasaki, Tohoku Univ., Japan
- E-4 Effects of the Continental Shelf on Harbor Resonance.
Philip L.F. Liu, C.I.T., U.S.A.
- E-5 Seiches in Bays Forming a Coupled System.
M. Nakano and N. Fujimoto, Tokai Univ., Japan

Session F - Tsunami Runup

- F-1 Amplification of Linear Long Waves Inside Bays.
A. Mano, Tohoku Univ., Japan

- F-2 Numerical Simulation of Tsunami Propagation and Runup.
C. Goto and N. Shuto, Tohoku Univ., Japan
- F-3 Tsunami Runup and Backwash on a Dry Bed.
K.K. Chu and T. Abe, Asian Inst. Tech., Thailand
- F-4 Research on Shoreline Wave Height and Land Runup Height of Tsunami on Uniform Sloping Beaches.
H. Togashi, Nagasaki Univ., Japan
- F-5 Wave Front Condition and Friction in the Tip Region of the Runup of Tsunami on Dry Bed.
H. Matsutomi, Akita Univ., Japan
- F-6 Effects of Large Obstacles on Tsunami Inundation.
N. Shuto and C. Goto, Tohoku Univ., Japan

Session G - Mitigation of Tsunami Hazards and Socio-economic Effects

- G-1 Types of Tsunami Disasters and Protection Measures in Japan.
K. Horikawa, Univ. Tokyo and N. Shuto, Tokyo Univ.
- G-2 Countermeasures Against Tsunami in Fishing Villages of Sanriku Coast in Japan.
T. Fukuchi and K. Mitsuhashi, Fisheries Agency, Japan
- G-3 Design and Construction of Ofunato Tsunami Protection Breakwater.
T. Matsumoto and Y. Suzuki, Ministry of Transport, Japan
- G-4 On the Function of Seawalls and Breakwaters to Mitigate Tsunami Hazards.
T. Iwasaki and A. Mano, Tohoku Univ., Japan
- G-5 Land Management Guidelines for Tsunami Hazard Zone.
J. Preuss, Urban Regional Res., U.S.A.
- G-6 Tsunami Impact on Society.
G. Pararas-Carayannis, ITIC, U.S.A.

Session H - Harbor Oscillations by Long Waves and Tsunamis (2)

- H-1 A Numerical Study of the Tsunami Response of a Harbor.
P.D. Farrar, USAE Waterways Experiment St., U.S.A.
- H-2 On the Hydraulic Aspects of Tsunami Breakwaters in Japan.
K. Tanimoto, Port and Harbour Res. Inst., Japan
- H-3 The Excitation of Harbors by Tsunamis.
F. Raichlen, T.G. Lepelletier and C.K. Tam, C.I.T., U.S.A.

Session I - Historical Study of Tsunamis

- I-1 Historical Study of Tsunamis at Tofino, Canada.
S.O. Wigen, Inst. Ocean Sci., Canada

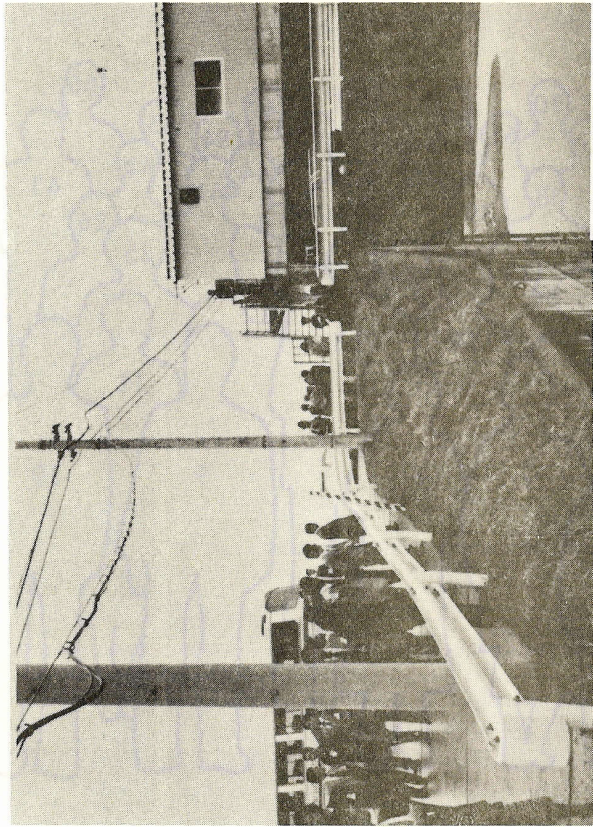
- I-2 Colombia-Peru Tsunami Observed Along the Coast of Japan.
T. Hatori, Univ. Tokyo, Japan
- I-3 The Biggest Tsunami in the Sanriku Districts.
K. Iida, Aichi Inst. Tech., H. Suzuki, Y. Osawa and H. Miyoshi,
Tokyo Univ. Fisheries, Japan
- I-4 The Tsunami and Associated Seiches as Recorded on Current Meters and
a Pressure Gauge in Otsuchi Bay.
N. Shikama, Univ. Tokyo, Japan
- I-5 Historical Study of Tsunami at Miyako, Japan.
M. Okada, Japan Meteorological Agency and M. Tada, Miyako Weather
Station, Japan
- I-6 Report on the Earthquake and Tsunami of Sept. 20, 1498.
Y. Tsuli, National Res. Center Dis. Prevention, Japan



Opening Ceremony at
Sendai



Arrow points to mark of
inundated level (5.2 m
above M.S.L.) of the
1960 Chile tsunami in
Ofunato



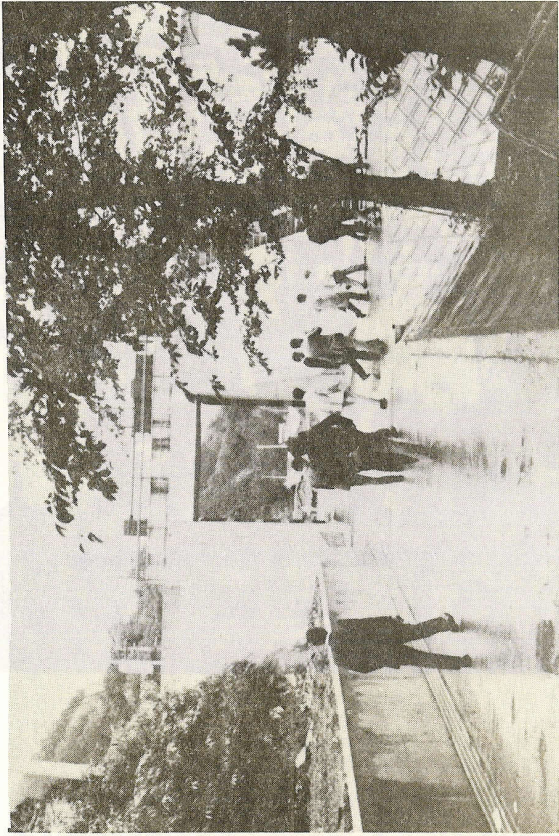
Tsunami gate at the mouth of river at Okkirai.



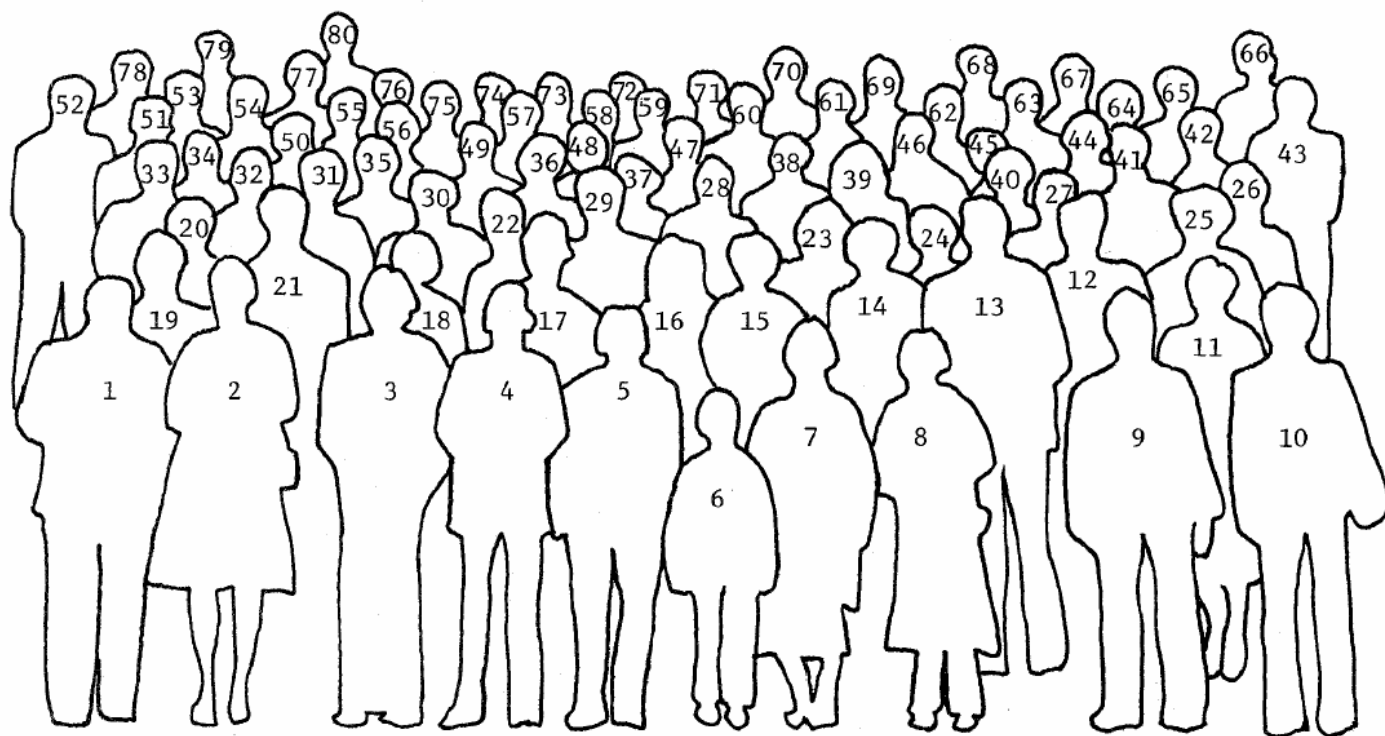
Gate of tsunami breakwaters at Okkirai.



Syd Wigen of Canada shows inundated level of the 1933 Sanriku tsunami at Okkirai (5.6 m above M.S.L.).



Gate of tsunami breakwaters at Hongo, Toni.



- | | | |
|----------------------------|-------------------|----------------------|
| 1. Pararas-Carayannis | 31. Takahashi | 61. Farreras |
| 2. Mrs. Pararas-Carayannis | 32. Hino | 62. Tsuji |
| 3. Wu | 33. Shimakura | 63. Uehara |
| 4. Hatori | 34. Hayashi | 64. Hitoshi Tanaka |
| 5. Iwasaki | 35. Kajiura | 65. Goto |
| 6. G. Pararas-Carayannis | 36. Kinoshita | 66. Narushima |
| 7. Mrs. Iwasaki | 37. Fijimoto | 67. Chu |
| 8. Mrs. Iida | 38. Kuroiwa | 68. Camfield |
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| 16. M. Suzuki | 46. Vargas | 76. Nishizawa |
| 17. Miyata | 47. Agemori | 77. Mano |
| 18. Ito | 48. Y. Kondo | 78. Narayama |
| 19. Unohana | 49. Yakuwa | 79. Hiromichi Tanaka |
| 20. Horikawa | 50. Shikama | 80. Sugawara |
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| 25. Wigen | 55. Aida | |
| 26. Ogawa | 56. Saito | |
| 27. Raichlen | 57. Katsuyuki Abe | |
| 28. Loomis | 58. Hase | |
| 29. Nakano | 59. Tanimoto | |
| 30. Kanamori | 60. Aguila | |



Organizing Committee

The IUGG ladies Organizing Committee sponsored a number of interesting cultural tours and visits for the wives and families of scientists participating in the IUGG Tsunami meeting. Shown above are wives and children of participating scientists visiting a beautiful garden in Sendai. (Photo by Mrs. Iwazaki)

Iran Earthquakes, June - July 1981

An earthquake of magnitude 6.9 Ms struck Iran's Kerman Province on 11 June 1981 leaving at least 3000 persons dead, thousands of injured and virtually destroying the village of Golbaft. The quake epicenter was at 29.98°N 57.72°E about 850 Km SE of Teheran.

A second earthquake measuring 7.3 Ms occurred on 28 July 1981, also in the Kerman Province of Iran. The quake occurred at 30.09°N 57.84°E at 1722 (GMT) in Southeast Iran. Its depth of focus was shallow. The epicenter of this quake was about 80 Km ESE of the provincial capital of Kerman and within 30 Km of the 6.9 Ms earthquake of 11 June 1981.

Pagan Volcano Erupted

Mount Pagan broke a 55-year sleep on May 15 with an explosive eruption. The Pagan Island is located 300 miles north of the Island of Guam. The eruption covered much of the island with ash and lava flows. All islanders had to be evacuated. A team of three scientists from the Hawaiian Volcano Observatory was sent to the island. When they overflew the island on 17 May at about 1200, the eruption had ended. Lava had advanced about 1 km down the NE and NW flanks from the summit. The SW

flank flow had partially covered the airstrip, but had stopped before reaching the village. A salvage team returned to the island a week after the eruption to salvage what has not been ruined. Exploration revealed that the road and much of the island's airstrip were covered by lava up to 30 feet deep. The water catchment system is clogged with cinders. A complete evacuation was recommended by the scientists. They declined to estimate when residents could return to the island.

Southwest Pacific Earthquakes, 6-15 July 1981

Two major earthquakes occurred in the SW Pacific Ocean in July. The first earthquake occurred on 6 July in the open ocean about 250 km SE of the Loyalty Islands at 0308 (GMT) at 22.26°S 171.73°E. Its magnitude was 7.0 Ms and its depth of focus was shallow. The second earthquake occurred on 15 July at 0759 (GMT) and its epicenter was at 17.30°S 167.59°E, about 100 km WNW of Vila, and caused some damage in the Shepherd Islands about 50 km N of Vila. Its magnitude was 7.1 Ms and its depth was 30 km. It is not known whether a minor tsunami was generated by either event, but ITIC is in the process of investigating.

Small Tsunami Generated by the Earthquake in Greece on 4 March 1981

The March 4 earthquake that occurred in Greece, with a magnitude of 6.5, generated a 1-m high tsunami that covered the coastal area between Corinth and Loutraki at the end of the Gulf of Corinth.

Tsunami in South Africa

Cmdr. C. F. Stokes, Superintendent of the Tidal Branch of the Hydrographic Office, Republic of South Africa sent to ITIC tide gauge recordings from stations at Knysna, Mossel Bay and Port Elizabeth for the early part of May 1981. Abnormal tidal fluctuations having the characteristics of a tsunami appear on the records for May 11 (local date). An investigation undertaken by ITIC shows that an earthquake occurred in the vicinity of the Atlantic-Indian Rise during that period was on the 12th of May at 1242 43.9 (UTC date and time) at 36.060°S Latitude and 48.142°E Longitude. The earthquake was extremely shallow (10 km), and had a magnitude of about 5. Taking into consideration time and date differences, as well as tsunami travel time from the epicentral area about 800-900 nautical miles away, ITIC concluded that this particular earthquake was responsible for the small tsunami experienced at these ports. The Knysna record shows a tsunami double amplitude (crest to trough) of 35 centimeters.

UNESCO - IOC - ITSU

Tenth Session of the Working Committee on International Oceanographic Data Exchange Held

The above mentioned session was held from 5 to 13 August 1981 in Hamburg, Federal Republic of Germany.

Topics discussed in the session included: Work Accomplished in the Intersessional Period, Co-operation with International Organizations and Other Bodies on Matters Concerning Ocean Data Exchange, Requirements of Ocean Services and Global Programmes, Acceleration of Data Flow in the IODE System, and Future Areas of Development of Ocean Data and Management Systems.

New Member State of IOC

The People's Republic of Mozambique has formerly become a member of the Intergovernmental Oceanographic Commission effective April 8, 1981, as announced by the Secretary of IOC.

Dr. Iouri Oliounine Assumes Responsibility for ITSU Matters

Dr. Iouri Oliounine, Assistant Secretary, Intergovernmental Oceanographic Commission (IOC) assumed the responsibilities for matters related to the Tsunami Warning System; succeeding Dr. Gunter Giermann, Deputy Secretary of IOC.

European Conferences on Earthquake Hazard

Three conferences held in Europe demonstrated a growing interest in earthquake hazard assessment and the urgent need to present information on such assessment in a form more suitable for direct application to earthquake engineering, physical planning and economic analysis.

The first conference (Varna, Bulgaria, 5-10 May 1981) discussed research programmes of the Academies of Sciences of socialist countries in the fields of geophysics, including the investigation of earthquake hazards in Central and Eastern Europe, the development of earthquake prediction methods, the structure and dynamics of the atmosphere and the establishment of data bases. It is evident that countries in the region are concentrating considerable resources on natural hazard mitigation, and that current research programmes should produce hazard maps and other documents within the next five years.

The second conference (Seminar on Seismic Hazard, Vulnerability and Risk, in Herceg Novi, Yugoslavia, 11-15 May 1981) was organized within the UNDP-financed Project on Earthquake Risk Reduction in the Balkan Region. The project is being executed by UNESCO, and UNDRO is involved as an associated agency, collaborating in vulnerability analysis and earthquake

disaster preparedness. The seminar was very instrumental in unifying certain basic definitions and concepts which so far were not uniformly interpreted by seismologists, engineers and urban planners. Estimated percentage of damage for a particular type of structure exposed to different intensities of ground shaking, as well as levels of acceptable risk were identified as items deserving immediate attention. The output of some activities of the project will be used in implementing two other similar projects in the Balkan region, i.e. Physical Planning in S.R. Montenegro (HABITAT) and Building Construction under Seismic Conditions in the Balkan Region (UNIDO/UNDO).

The third conference (Second Symposium on Analysis of Seismicity and on Seismic Hazard, Liblice near Prague, Czechoslovakia, 18-23 May 1981) was co-sponsored by the European Seismological Commission, the Commission of Academies of Socialist Countries for Planetary Geophysics (KAPG) and UNDRO. The programme covered all stages in analysing seismic hazard, and forty papers presented at the symposium demonstrated the results achieved in European countries, particularly in estimating the level of seismicity, developing statistical models and mapping seismic hazard. (*From UNDRO News, July 1981*)

INTERNATIONAL TSUNAMI INFORMATION CENTER - HONOLULU

Director of ITIC Participates in the 1981 IUGG Tsunami Symposium

Dr. George Pararas-Carayannis, Director of ITIC, participated in the 1981 IUGG Tsunami Symposium in Japan on May 25-28, and presented a paper entitled "Tsunami Impact on Society." In addition, Dr. Pararas-Carayannis participated in the business meeting of the IUGG Tsunami Commission of which he is a member, and coordinated with Japanese scientists items related to ICG/ITSU and to the Tsunami Warning System.

Chairman of ITSU Visits ITIC

Mr. Gerry Dohler, Chairman of the International Coordination Group for the Tsunami Warning System in the Pacific (ICG/ITSU) visited ITIC on May 19-23. Mr. Dohler conferred with Dr. George Pararas-Carayannis, Director of ITIC on matters related to the Tsunami Warning System, action items from the last ICG/ITSU Conference of March 1980, and on the agenda for the 1982 ICG/ITSU Conference. Following the meetings in Honolulu Mr. Dohler departed for Japan for the IUGG Tsunami Symposium.

Administrator of Philippine Civil Defense Visits ITIC

Colonel Victor R. Pagulayan Jr., Administrator of the Office of Civil Defense of the Ministry of National Defense of the Philippines visited ITIC in August, and participated in the Civil Defense Tsunami Exercise and post-exercise evaluation. In addition to the Civil Defense facilities in Honolulu, Col. Pagulayan was escorted by Dr. George Pararas-Carayannis,

Director of ITIC, to the Pacific Tsunami Warning Center (PTWC) for familiarization with operational procedures of the Tsunami Warning Center.

Vice-Chairman of ITSU Visits ITIC

Captain Cesar Vargas and Captain Jorge del Aguila of the Peruvian Navy visited ITIC in June 1981, on their way back to Lima from the IUGG meetings in Japan. Captain Cesar Vargas is the Vice-Chairman of the International Coordination Group for the Tsunami Warning System in the Pacific (ICG/ITSU) and a member of the task team charged with the responsibility at the last ITSU meeting in Chile, in 1980 with the preparation of a proposal for the establishment of Regional Warning Center in South America. Both Captain Vargas and Captain Aguila met with the ITIC Director, Dr. George Pararas-Carayannis and discussed Peru's participation in the Tsunami Warning System, and the development of a proposal for the establishment of a Regional Tsunami Warning System which would include Colombia, Ecuador, Peru, and Chile. Captain Vargas is the coordinator for this task.

Visitors to ITIC

Recent visitors to ITIC included among others the following:

Ms. Ola Watford, National Oceanic & Atmospheric Administration
Mr. M. Kanakogi, Fire Defense Agency, Japan
Mr. Sunny Kim, Hawaii County Civil Defense
Mr. Tom Ota and Mr. Jack Leishman, Honolulu Community College
Mr. Robert Eppley, Ex-director of the Alaska Tsunami Warning Center
Mr. Julio Kuroiwa, National University of Engineering, Peru
Mr. Robert Williams, Oahu Civil Defense
Mr. Richard Sillcox and Dr. William Mass, Pacific Tsunami Warning Center
Mr. Jimmy Lee, U.S. Corps of Engineers, Pacific Ocean Division
Ms. Dolores Christensen, Brigham Young University, Hawaii
Mr. Gregory Slaughter, Santa Monica Police Department
Mr. John Thwaitis, Canadian Civil Defense
Col. Victor R. Pagulayan Jr., Director, Civil Defense-Philippines
Mr. Alfredo Magpoc, Pearl Harbor Naval Shipyard
Ms. Elvira Vasquez Carruitero, Fishery Ministry, Peru

ITIC Informational Services

ITIC responds routinely to numerous inquiries about tsunami information and data from scientists and engineers throughout the world. Recently ITIC responded to many inquiries among which were inquiries from the

Republic of South Africa, Argentina, Philippines, Peru, Ecuador, Switzerland, Canada, Japan, New Zealand, U.S.A., France, Portugal, Australia, Hong Kong, Spain, U.S.S.R., Chile, Colombia, Papua New Guinea, Fiji, Kingdom of Saudi Arabia, Hungary, and the Principality of Monaco.

ITIC Resumes Work on Tsunami Bibliography

Under the support of the U.S. Nuclear Regulatory Commission (NRC), ITIC resumed its work on an updated annotated tsunami bibliography. A proposal entitled "Review and Technical Editing of Tsunami Bibliography" submitted by ITIC, received funding from NRC. Dr. George Pararas-Carayannis is the principal investigator assisted by Mrs. Bonnie Dong, who is the ITIC research librarian.

ITIC under a contract with NRC has previously prepared a draft tsunami bibliography. Due to the exhaustion of funding in the project, only the data collection phase was completed and the bibliographic citations in index cards were delivered to NRC. This index card collection was recently converted to a typed manuscript by NRC. This collection is far from being in final publishable form. ITIC has agreed to perform the extensive review and editing of the existing draft tsunami bibliography to improve its technical content, accuracy and relevancy, prior to publication. It is anticipated that the project will be completed by the end of 1981.

Tsunami Exercise

The International Tsunami Information Center (ITIC) in collaboration with the State of Hawaii Civil Defense co-sponsored a statewide tsunami disaster exercise on August 11, 1981. The exercise was based on a major tsunami situation, designed to test the effectiveness of the State of Hawaii's plan for emergency preparedness, and its purpose was to stimulate a statewide awareness of Civil Defense functions, facilities and procedures. The pre-wave phase emergency response actions by government and civil agencies and organizations were monitored. The exercise was based on a scenario prepared by Dr. George Pararas-Carayannis of ITIC depicting a major event and providing data on the earthquake and expected tsunami wave arrival and runup at different points of the coast.

Because of the general nature of the exercise, it is believed that the scenario and methodology can be adopted by other ITSU Member nations in stimulating awareness of Civil Defense functions, facilities and procedures at other areas of the Pacific, and as the basis for similar training. Copies of all materials related to this exercise were sent to all the tsunami national contacts of ITSU Member States in the hope that similar disaster exercise be undertaken to test the effectiveness of Civil Defense plans for emergency in ITSU Member States. Copies of the Tsunami exercise materials can be obtained by writing to: The Director, ITIC, P.O. Box 50027, Honolulu, Hawaii 96850 USA.

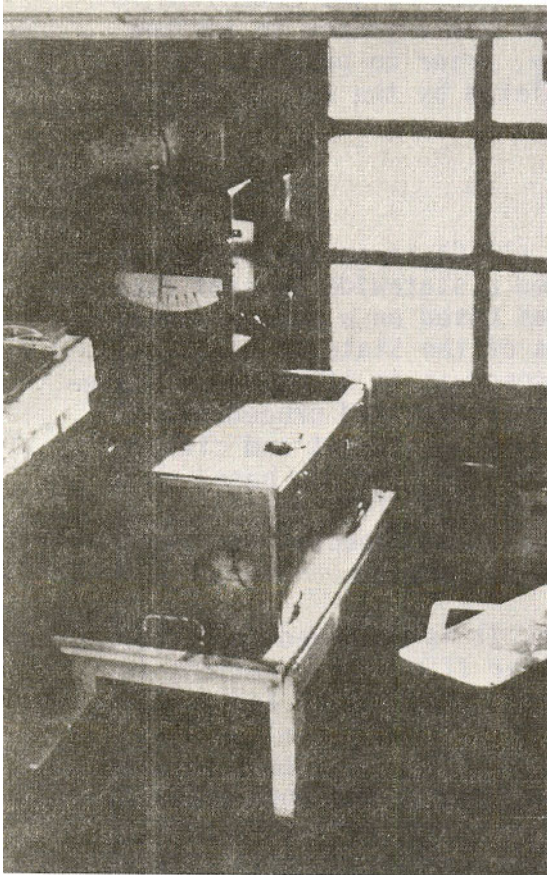
NATIONAL AND AREA REPORTS

New President for the Colombian Commission of Oceanography

Captain Jaime Sanchez Cortes of the Colombian Navy was recently named as the President, Comision Colombiana de Oceanografia, succeeding Mr. Ones Gustavo Angel Mejia.

GOES Tsunami Platforms Installed

Mr. Mark G. Spaeth, U.S. National Tsunami Contact completed earlier this year the installation of four automated GOES Tsunami Gauge Platforms. Installation of these gauges was made at Easter Island and Antofagaska, Chile at La Punta, Peru, and at Baltra Island, Galapagos Islands, Ecuador. An automated seismic platform was installed at the NASA station at Peldehue, Chile.



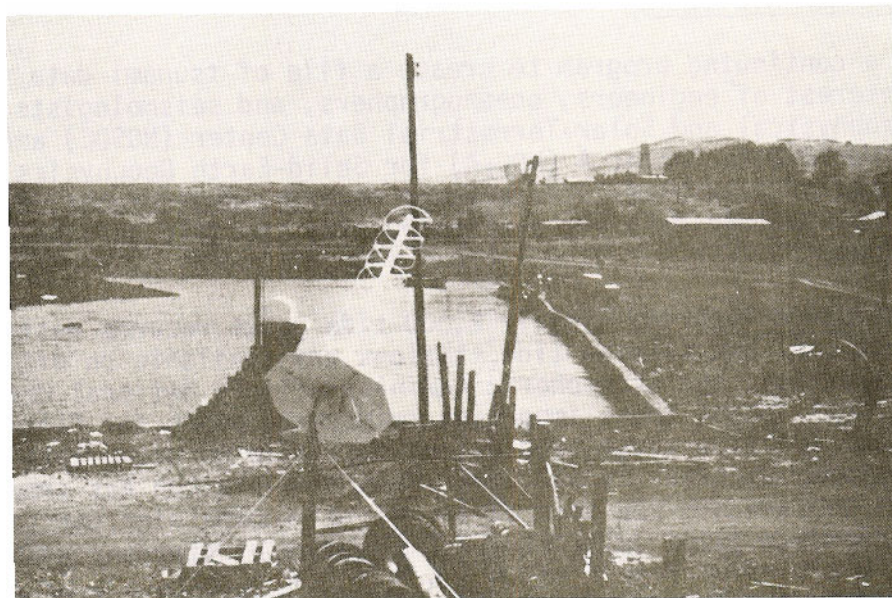
Standard tide gauge and Bristol transmitter at La Punta.



Port Security Office, Antofagasta, where microprocessor and GOES radio are installed.



Baltra Island Tide House



Easter Island - View from tide house toward University of Hawaii tide gauge.

Change to Communication Plan for Tsunami Warning System

United States National Oceanic & Atmospheric Administration (NOAA), National Weather Service issued in July 1981 Change Number 1 to the Communication Plan for Tsunami Warning, Ninth Edition, dated September 1980. Copies of the revisions were sent to all holders of Communication Plan. If a copy of the revision is needed, write to Mr. Mark Spaeth, NOAA/National Weather Service, Oceanographic Services Branch W161, Silver Spring, Maryland 20910, USA.

Tsunami Station Inspection

Pacific Tide Party personnel of NOAA, Kathy Andreen, Kenneth Welker, Marianne Molchan, J. C. Talbott, and R. Behn inspected the following stations:

17 Nov 1980	Midway
1-3 Dec 1980	Kwajalein Island
5-7 Dec 1980	Truk Atoll
12 Dec 1980	Malakal, Palau
14-15 Dec 1980	Yap, West Caroline Islands
8-9 Feb 1981	Kodiak, Alaska
20 Mar 1981	Crescent City, California
18 Apr 1981	Fort Point, California

ANNOUNCEMENTS

Tsunami Data Now Available

As part of a continuing program to create a file of tsunami data to support the interest of engineers, oceanographers, and seismologists, the National Geophysical and Solar-Terrestrial Data Center (NGSDC) and the collocated World Data Center A (WDC-A) for Solid-Earth Geophysics have compiled a set of data bases. Tide gauge records, photographs, seismograms, and bathymetric data are available. The specific data holdings are as follows:

Pacific Tide Gauge Records: Nearly 2,000 tide gauge records dating back to 1850, from U.S. and foreign tide stations are available on microfiche. The National Oceanic and Atmospheric Administration's National Ocean Survey (NOS) has loaned these important records to NGSDC for filming and distribution. The tide gauge records are available on microfiche for \$3.50/fiche (minimum order is \$10.00). Each tide station has supplied records that contain a 5-day span of wave data encompassing the tsunami event with adequate gauge quiet time. The number of stations available for a given event range from 1 to 50. A few marigrams have been digitized for review by selected researchers. Demand will determine future digitization of analog records.

Tsunami Photographs: A collection of 667 photographs of tsunami wave activity and effects has been compiled. A catalog describing the photographs is available from NGSDC. Contributions of tsunami wave and damage photographs are welcome. WDC-A/NGSDC will supply like amounts of data for contributions received. Photographs should be accompanied by descriptive captions and appropriate credit information. The costs of photographs and slides available from NGSDC follow:

8" x 10" prints \$5.50 each

4" x 5" negatives \$5.50 each

35-mm slides \$2.15 each

Minimum order is \$10.00

Seismograms: Copies of seismograms from the World-Wide Standard Seismograph Network since 1962 for about 120 stations are available on 35- and 70-mm film and since 1978 on microfiche. Since 1972 this collection of about 5,000,000 seismograms has been augmented by about 150 additional stations world-wide for large magnitude (7.5 and larger) and special interest earthquakes. A program is underway to microfilm older seismograms for all large earthquakes from selected stations since 1900. Digital data from the very long period International Deployment of Accelerometers (IDA) world-wide network of gravimeters are available since 1975 and from the digitally recording Seismic Research Observatories (SRO) and High-Gain Long Period (HGLP) network since 1977. A digital Earthquake Data File has information on approximately 150,000 earthquakes, including whether or not a tsunami was recorded or observed.

Bathymetric Data: NGSDC has a collection of about 50,000,000 bathymetric observations of the U.S. coastal areas, collected since 1930 by the U.S. Coast and Geodetic Survey and its successor, NOS. These data are on magnetic tape and can be formatted to provide plots, even-space grids, or profiles.

Address orders and inquiries to:

World Data Center A for Solid-Earth Geophysics
NOAA/EDIS/NGSDC D62
325 Broadway
Boulder, CO 80303
U.S.A.

The Tsunami Society Needs a Logo

You are hereby invited to submit a design which you think is suitable as a logo for stationery, envelopes, flags, plaques, awards, and other Tsunami Society materials.

Each design you submit should be on one piece of paper, nominally letter size, drawn in ink of one color, with your name and address shown. By submission of a design, the creator hereby agrees to allow The Tsunami Society to use the design for its logo. Submit your design(s) by

31 December 1981 to The Tsunami Society, P.O. Box 8523, Honolulu, Hawaii 96815.

Global Digital Seismograph Network

The National Geophysical and Solar-Terrestrial Data Center (NGSDC) archives and disseminates analog and digital data from the World-Wide Standardized Seismograph Network (WWSSN), the Seismic Research Observatories (SRO), the Modified High-Gain Long Period stations (ASRO), the High-Gain Long Period (HGLP) network, and the Digital World-Wide Standardized Seismograph Network (DWWSSN). These are available as data tapes and analog copies.

Figure 1 shows the locations of the stations in the digital recording network. Analog data from the stations are available after their installation date. Digital data are available since March 1, 1977. Digital data for earlier intervals from the HGLP and SRO stations may be obtained from the Seismic Data Analysis Center, 312 Montgomery Street, Alexandria, VA 22714.

For information on formats and FORTRAN software to read the Global Digital Seismograph Network-Day tapes, write to: Chief, Global Seismology Branch, USGS Mail Stop 967, DFC P.O. Box 25046, Denver, CO 80225.

International Conference on Coastal Engineering

The 18th International Conference on Coastal Engineering will be held during 14-19 November 1982, in Cape Town, Republic of South Africa. The conference will bring together engineers, geologists, planners and coastal scientists from all around the world to discuss and exchange information relative to coastal engineering. Topics that will be covered at the conference include:

- Wind current and wave action.
- Tides and long waves.
- Sedimentary processes and coastal morphology.
- Estuary and inlet behavior.
- Coastal structures and recreational facilities.
- Ship motions as related to harbour entrance design.
- Ocean outfall design and construction.
- Environmental aspects in coastal engineering design.

Contributions are invited on any of the above topics. A final Call for Papers will be distributed in August 1981. Every attempt will be made to include as many papers in the programme as possible, particularly to encourage young engineers and coastal scientists to take part in the conference. The Paper Review Committee, however, reserves the right to make the final decision on the acceptance of papers and the form of the presentation.

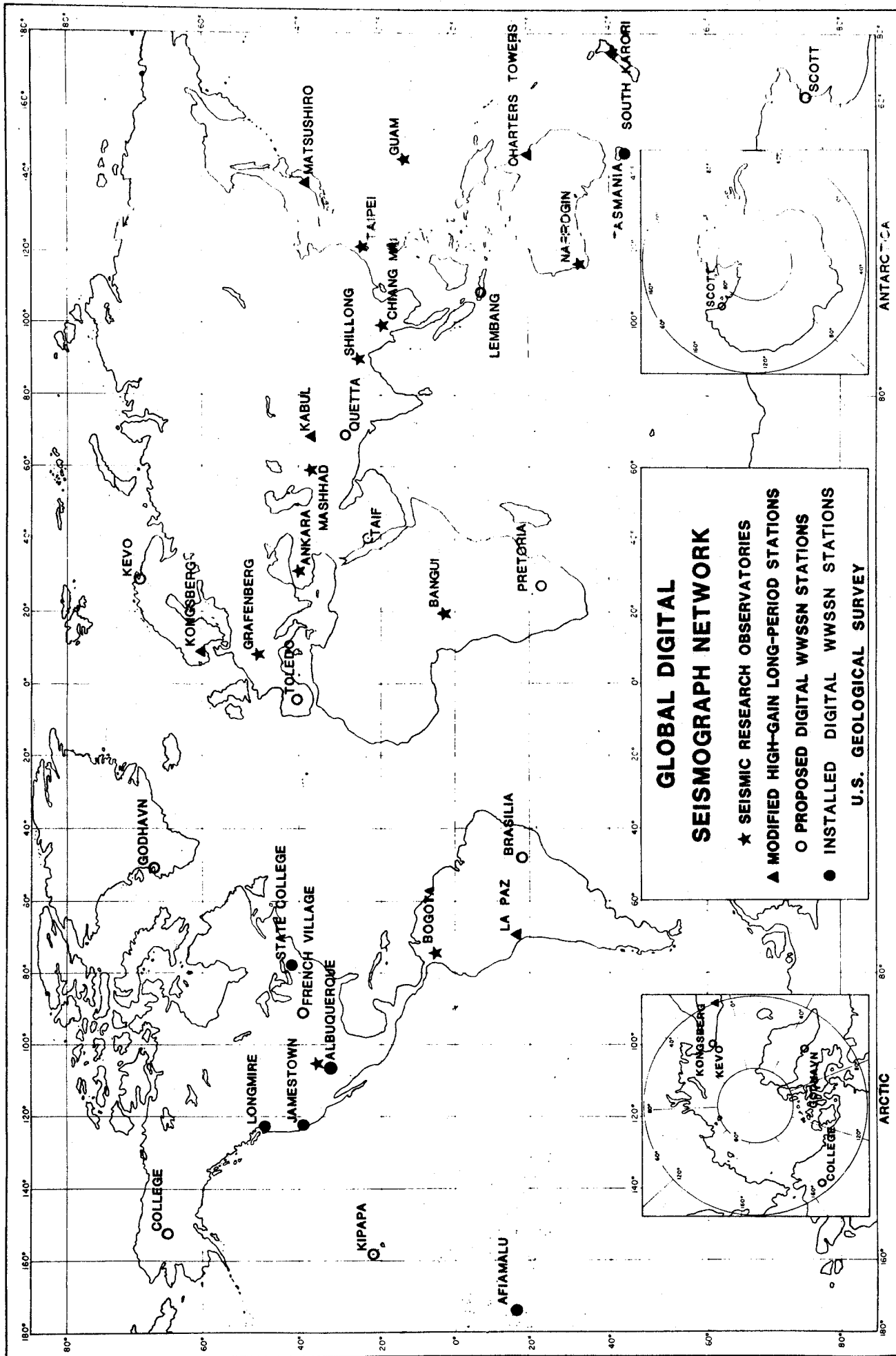


Figure 1. Map showing locations of digital recording network stations.

Five copies of a synopsis (not to extend beyond two pages, including illustrations) of each paper proposed for the conference should be sent before 31 October 1981 to:

Professor Billy L. Edge, Secretary
Coastal Engineering Research Council
Department of Civil Engineering
Clemson University
Clemson, South Carolina 29631
USA

Requests for the Call for Papers or additional information can be sent to the same address.

Coastal Structures '83

The second specialty conference on the design, construction, maintenance, and performance of port and coastal structures will be held on 9 to 11 March 1983 in the Washington, D.C., area. It will be similar in scope and character to the initial conference having the same theme--Coastal Structures '79. Primary responsibility for Coastal Structures '83 will reside with the Waves and Wave Forces Committee, Waterways, Ports, Coastal and Ocean Division, American Society of Civil Engineers. Other societies and agencies will serve as cosponsors.

A list of important dates is as follows:

1 October 1981	Formal call for papers.
15 April 1982	Deadline for abstract submission.
15 June 1982	Notification of acceptance or rejection of papers.
15 November 1982	Deadline for receipt of final papers in camera-ready form.
9-11 March 1983	Conference.

For additional information contact:

Dr. Robert M. Sorensen
CERC--Kingman Building
Leaf and Telegraph Roads
Fort Belvoir, VA 22060
USA
(202) 325-7378

The Law of the Sea Institute - 15th Annual Conference

The above mentioned conference, sponsored by the University of Hawaii Law School and cohosted by Hawaii Ocean Law Association, will be held from October 5 to 8, 1981 in Honolulu, Hawaii. The Law of the Sea Institute is an international forum for exchange of information on the rules

for the use of sea and its resources. It was established in February 1965 at the University of Rhode Island. The annual conference Series began in 1966. The conferences bring together ocean scholars of every specialization, be they from academia, industry, or government. The theme of this 15th Conference will be: The Law of the Sea and Ocean Development Issues in the Pacific Basin. For further information, please contact:

Dr. Scott Allen
Associate Director
Law of the Sea Institute
University of Hawaii
2540 Dole St. Holmes 401
Honolulu, HI 96822
USA
(808) 948-6750

Seventh European Congress on Earthquake Engineering

Seventh European Congress on Earthquake Engineering, Technical Chamber of Greece and the European Association for Earthquake Engineering, Athens: September 6-11, 1982. The conference will examine such problems as rural housing in earthquake-prone areas, cost-benefit analysis in earthquake engineering, coordination of European research on earthquakes, resistance of structures and lifelines, and repairing, and strengthening structures and monuments. Further information is available from C. A. Symakezis, Organizing Secretary 7-ECEE, Technical Chamber of Greece, 4, Karageorgi Servias str., Athens 125, Greece.

Fourth Conference on Hydrometeorology

Fourth Conference on Hydrometeorology, American Meteorological Society and the American Geophysical Union Precipitation Committee. Reno, Nevada: October 7-9, 1981. The conference, intended to foster dialogue between meteorologists and hydrologists, will discuss such topics as prediction of precipitation, application of precipitation forecasts, precipitation climatology as the basis of hydrologic design and planning, and floods and flash floods in the western United States. A proceedings volume will be printed and distributed at the meeting. For additional information, contact Ulrich Kappus, Program Chairman, Dames and Moore, 1626 Cole Blvd., Golden, CO 80401, USA, (303) 232-6262.

Tsunami Hazard and Community Preparedness in Alaska

"Tsunami Hazard and Community Preparedness in Alaska," George W. Carte, NOAA Technical Memorandum #NWS AR-29, February 1981, 20 pp, \$3.00. Available from the Environmental Science Information Center, Environmental Data and Information Service, NOAA, 3300 Whitehaven Street, N.W., Washington, DC 20235, USA, (202) 634-7281.

The memorandum is the report of an evaluation of Alaska's tsunami warning system, conducted by the National Weather Service's Alaska Tsunami Warning Center. Questionnaires were distributed to officials of coastal communities, to the school principal or teacher in communities too small to have organized municipal governments, and to several logging camps, to determine the population at risk, elevation of structures, communication facilities available, and the level of awareness of the NWS tsunami warning system. Many smaller communities were found to need outside help to achieve minimal preparedness levels. Plans were developed to distribute tsunami awareness information and "safe area" maps in local phone books.

Action on Earthquake Preparedness - SCEPP

The Southern California Earthquake Preparedness Project (SCEPP) began its operation in late 1980 to encourage preparedness for a catastrophic earthquake. SCEPP was established to assist in the development of plans and policies to be coordinated with existing emergency preparedness and disaster response activities in addition to developing an earthquake prediction information and preparedness program to promote public understanding of prediction. SCEPP was created with state and federal funds for a period of two years although it is estimated that it may take three to five years to form a full program for SCEPP's planning region - Los Angeles, San Bernardino, Riverside, Orange and Ventura counties.

Under its first agreement with San Bernardino County SCEPP will help the county assess its earthquake vulnerability, develop mitigation/preparedness plans for specific sites within the county, and formulate policies for response to an earthquake prediction/warning. The county will contribute personnel and data to accomplish the tasks. SCEPP is now negotiating its next agreement with the city of Los Angeles.

For more information, contact:

Richard Andrews
Education/Evaluation Officer
South California Earthquake Preparedness Project
6850 Van Nuys Blvd.
Suite 110
Van Nuys, CA 91405
USA
(213) 787-5103

Two Reports on Studies of the Hilo Bay of Hawaii Completed

Two reports: "Geological, Biological and Water Quality Investigations of Hilo Bay," dated October 1980, and "Hilo Bay, A Chronological History," dated March 1981 were distributed by the Honolulu Office of the U.S. Army Engineer District. These reports are part of the Hilo Area Comprehensive Study as authorized by the Water Resources Development Act of 1976. The objective of the comprehensive study is to study and identify methods to develop, utilize and conserve water and land resources in the Hilo area. "Hilo Bay, A Chronological History" offers a historical perspective of

water resources problems in the general Hilo area including ocean navigation, water-based recreation, beach erosion, and uses of flood-prone lands. The other report was prepared to provide baseline analyses for engineering and planning of improvements for shore protection, deep draft and small craft navigation, and environmental quality in Hilo Bay.

Joint Oceanographic Assembly to be held in Halifax, August 1982

A major event for the oceanographic community will be the Joint Oceanographic Assembly (JOA), to be held at Dalhousie University, Halifax, Nova Scotia, Canada from 2 to 13 August 1982. It will be the fifth such multi-disciplinary meeting in 22 years where marine scientists from around the world can share their knowledge about recent developments in their respective fields.

The scientific programme, covering many aspects of physical, biological and chemical oceanography as well as geology and geophysics, will consist of invited papers and general symposia on selected topics of interdisciplinary interest, special symposia on more specialized subjects and various association sessions.

Other activities are planned for JOA participants. These include an international exhibition of marine science equipment and excursions to various research establishments in the Halifax-Dartmouth area such as:

Bedford Institute of Oceanography (Canada's largest marine science research centre)

National Research Council

Nova Scotia Research Council

Dalhousie University

Federal Government's Fisheries Laboratory

The Scientific Information and Publications Branch of the Canadian Department of Fisheries and Oceans has agreed to reproduce the abstracts of papers being presented. A copy of these abstracts will be provided to each delegate upon registration.

For registration contact: Mr. Leo O'Quinn, Executive Secretary, Joint Oceanographic Assembly -- 1982, 240 Sparks Street, 7th Floor West, Ottawa, Ontario, Canada K1A 0E6, tel: (613) 995-5659.

Krakatoa Remembered

To commemorate the 100th anniversary of Mount Krakatoa which erupted on the evening of August 27, 1883, the Indonesian Institute of Sciences will launch two years of scientific activities commencing in August of 1981 with expeditions to, and research on Mount Anak Krakatoa, the volcano born in 1927 on the site of the obliterated mountain. A symposium will be held in August of 1983. The following fields have been selected to

be covered in papers prepared for the meeting: volcanology, geology, geophysics, oceanography, marine and terrestrial biology, ecology, and the historical aspects of Krakatoa's eruption.

For more information, write to: Committee of the 100th Anniversary of Mount Krakatau, Lembaga Ilmu Pengetahuan Indonesia (LIPI), JL. Teuku Chik Ditiro 43, Jakarta, Indonesia.

ABSTRACTS AND RESUMES

Study on Tsunami Runup and Countermeasure, May 1981

Hiroyoshi Togashi, Professor
Department of Civil Engineering
Faculty of Engineering
Nagasaki University

This is an English translation of a thesis originally written in Japanese which was submitted in partial fulfillment of the requirements for the degree, Doctor of Engineering in Civil Engineering at Tohoku University, Sendai, Japan, in 1976.

Tsunami disasters are natural disasters caused principally by the runup on land of tsunamis. Because both the extent of damage and the scale of the afflicted area is great, countermeasure facilities have been constructed following each disaster in an effort to preserve the coast of the afflicted area and to allay the fears of the public. However, a scientific foundation has been absent in the design of these facilities, and only traces of previous flood levels have been employed as standards.

The present thesis is an experimental and analytical investigation of the phenomenon of on land runup concerning tsunamis adjacent to the shoreline and its prevention. That is, first, to shed light on the behaviour of tsunamis by dealing with the process of land runup normally incident to the shoreline already arriving near a coast shallower than several tens of meters, either while breaking on the sea or transforming without breaking, whether the shoreline is a continuous one like a sloping beach or a discontinuous one bordered by a quaywall.

Next, regarding the sheltering effect in cases where tsunami countermeasure facilities such as tsunami land dikes or tsunami land walls have been established on land, the devising of suitable methods for countermeasures against tsunami disasters has been investigated through the understanding of various effects on dikes and walls of runup tsunami concerning the wave height and wave pressure of shock wave, along with the succeeding reflected clapotis height and pressure, or the overflow height and velocity over the tops of dikes and walls, as well as the wave height, velocity and the rate of flow after overflowing to the rear of the dikes and walls.

Then, finally, as case studies of onshore runup of tsunami and its prevention, numerical analysis has been made of the sheltering effect and design wave pressure of the tsunami protection gates of the Omotogawa River and the Tashirogawa River in Iwate Prefecture, and a study has also been made on the Omotogawa River tsunami gate using a hydraulic laboratory model with detailed structure.

A Study on the Force of Ocean Waves Upon a Vertical Breakwater
(Abstract in English, Content in Chinese)

Huang Peiji, Yang Keji, Lu Changwu & Liu Laichen
First Institute of Oceanography
National Bureau of Oceanography

Simultaneous observations of both water level elevations and wave pressures upon a vertical breakwater in a harbour was made in the years 1973 and 1977. The data were analyzed statistically. Based on the analysis and linear theory, a technique is developed for calculating the spectrum of total pressure exerted on the vertical breakwater from the spectrum of incident waves. In addition, the formular $\bar{R} = \sqrt{2 \pi m_{0R}}$ is tested, where \bar{R} and M_{0R} are the average fluctuation range of total pressure and the zero-order moment of total pressure spectrum, respectively. The empirical relation of R to both R^+ and R^- are also derived from corresponding scatter diagrams, where R^+ and R^- are the crest value and the trough value of total pressure, respectively. Thus, with only the spectrum of incident waves and the distribution function of R , one can compute the statistics needed for coastal engineering design, such as $R^+ 1\%$, $R^- 1\%$, etc.

A comparison between the theory established in the paper and measurement shows reasonable agreement, so that the technique proposed here is applicable to engineering design.

Above abstract from ACTA Oceanology Sinica, Vol. 1, No. 2, Dec. 1979.

Seasat Detection of Waves, Currents and Inlet Discharge
Int. J. Remote Sensing, 1980, Vol. 1, No. 4 377-398

M. G. Mattie, D. E. Lichy
U.S. Army Coastal Engineering Research Center
Ft. Belvoir, Virginia 22060, U.S.A.
and
R. C. Beal
John Hopkins Applied Physics Laboratory
Laurel, Maryland 20810, U.S.A.

(Received 30 April 1980; revision received 13 August 1980)

Abstract: A new era of remote sensing for coastal and oceanographic monitoring was born on 26 June 1978 with the launch of Seasat. Duck-X was a 2 month experiment conducted during August to October 1978 off the

east coast of the U.S.A. for the validation of the Seasat synthetic aperture radar (SAR). During this field experiment, various oceanographic phenomena were monitored. Ground truth observations of these phenomena have been correlated with Seasat SAR imagery. The ground truth sensors included airborne photographic and radar imagery, meteorological satellite imagery, land based radars, and conventional wave gauges. This paper focuses on ocean surface waves, ocean currents and coastal inlet discharge.

Specifically, the direction and length of the principal ocean wave trains are compared for the periods of Seasat overflight of the Duck-X area. During these overflights significant wave heights were 1.5 m and less and the maximum wave period was 14 s. The current correlations concentrate on the western boundary of the Gulf Stream and its associated eddy structure. Inlet outflow is shown for inlets on the east coast of the U.S.A.

This ground truth study has indicated that the SAR imagery contains an unanticipated abundance of information on a variety of oceanographic and coastal phenomena.

Historical Tsunamis and their Studies

Tokutaro Hatori
Earthquake Research Institute
University of Tokyo

January 1981

A compilation of articles on historical tsunamis in Japan by Tokutaro Hatori and other authors in the Japanese language with abstracts in English. The articles include the following:

1. Religious Monuments of the Oshima Tsunami in 1741, West Hokkaido
2. Tsunami Magnitude and Wave Source Regions of Historical Sanriku Tsunamis in Northeast Japan
3. Propagation of Tsunamis from Sources off the Pacific Coast of Northeast Japan
4. Tsunamis in the South Kanto District
5. Monuments of the Tsunamis of 1703 and 1923 in the South Kanto District
6. Sources of Tsunamis Generated off Boso Peninsula
7. Sources of Large Tsunamis Generated in the Boso, Tokai and Nankai Regions in 1498 and 1605
8. Monuments of the 1703 Genroku Tsunami Along the South Boso Peninsula: Wave Height of the 1703 Tsunami and its Comparison with the 1923 Kanto Tsunami

9. Behavior of the Kanto Tsunamis of 1677 and 1703 along Kujukuri-hama: From the Field Investigation of Old Monuments
10. Documents of Tsunami and Crustal Deformation in Tokai District associated with the Ansei Earthquake of Dec. 23, 1854
11. Field Investigation of the Tokai Tsunamis in 1701 and 1854 along the Shizuoka Coast
12. Field Investigation of the Tokai Tsunamis in 1707 and 1854 along the Mie Coast, East Kii Peninsula
13. Sources of Large Tsunamis in Southwest Japan
14. Field Investigation of the Nankaido Tsunamis in 1707 and 1854 along the Osaka and Wakayama Coasts, West Kii Peninsula
15. Monuments of the Nankaido Tsunamis of 1605, 1707 and 1854 in the Shikoku District: Behavior of Historical Tsunamis and their Comparison with the 1946 Nankaido Tsunami
16. The magnitude of Tsunamis Generated in Hiuganada during the years, 1926-1970
17. Tsunami Behavior and Source Areas of Historical Tsunamis in the Japan Sea
18. Distribution of Tsunami Energy along the Coast of Japan and Tsunami Travel Times

On Migration Phenomena of Aftershocks Following Large Thrust Earthquakes in Subduction Zones

(Report of the National Research Center for Disaster Prevention, No. 25, March 1981)

Masajiro Imoto
National Research Center for Disaster Prevention
Japan

Abstract: The spatio-temporal patterns of aftershock sequences following large thrust earthquakes in subduction zones are investigated in relation to tectonic environment. A prominent pattern of seaward spreading of quiescent areas during a period of about 10 days after the main shock is detected, in many cases with similar tectonics of typical subduction zones. The pattern is displayed in various ways such as in space-time plots, distribution of space and time intervals among the shocks, and variation of the frequency decaying rate with distance from the main shock. The sequences of elongated aftershock area suggest that the spreading starts at a line source along the landward side of the aftershock area.

To account for the process of migration, a stress analysis in the source region is made by a two-dimensional finite element method with a fault gouge in sequence, which may represent a realistic tectonic process at preseismic, coseismic, and postseismic stages. The result of stress analysis at a postseismic stage is compared with the observed data in four cases. The criterion used for the aftershock occurrence is that the frequency of aftershock in a certain area during a certain period is proportional to the increasing rate of the shear stress in the space and time intervals. Comparisons with the observed data result in success, and spatio-temporal distributions of the sequences can be explained quantitatively. A few related problems such as postseismic deformation, frequency decay law and others are also discussed on the basis of the results.

Tsunamis - Harbor Oscillations Induced by Nonlinear Transient Long Waves

Thierry Georges Lepelletier

W. M. Keck Laboratory of Hydraulics and Water Resources
Division of Engineering and Applied Science
California Institute of Technology
Pasadena, California

October 1980

The process of excitation of harbors and bays by transient nonlinear long waves is investigated theoretically and experimentally. In addition, nonlinear shallow water waves generated in a closed rectangular basin by the motion of the basin are also examined.

Two numerical methods based on finite element techniques are used to solve the weakly nonlinear-dispersive-dissipative equations of motion and are applied to the basin excitation problem and the transient harbor oscillation problem, respectively. In the latter case, the open sea conditions are simulated by including a radiative boundary condition in time at a finite distance from the harbor entrance. Various dissipative effects are also included. In addition to the numerical results, analytical solutions are presented to investigate certain particular aspects of basin and harbor oscillations (e.g., the effects of viscous dissipation in a harbor with simple geometry).

Experiments conducted in the closed rectangular basin indicate that for a continuous excitation at or near a resonant mode of oscillation the linear theory becomes inadequate and the nonlinear-dispersive-dissipative theory must be used. For a transient excitation the validity of the linear theory depends on the value of the Stokes parameter. Indeed, some features not predicted by the linear theory can be directly inferred from the magnitude of this parameter.

Experiments on the continuous wave induced oscillations of a narrow rectangular harbor with constant depth show that at the first resonant mode convective nonlinearities can be neglected and a linear dissipative solution is sufficient to describe the waves inside the harbor. At the second

resonant mode which corresponds to a longer harbor relative to the length of the incident wave, nonlinear convective effects become important and must be incorporated into the numerical model. Also the characteristics of various sources of dissipation which reduce resonance in the harbor are investigated experimentally. The sources considered include, among others, laminar boundary friction, leakage losses underneath the harbor walls, and energy dissipation due to flow separation at the entrance of the harbor.

The good agreement obtained between the experiments and the nonlinear numerical model developed in this study suggests that this model could be used with some confidence to predict the response characteristics of prototype harbors. As an example, the results of this study have been applied to the response of Ofunato Bay (Japan) to the tsunami generated by the Tokachi-Oki earthquake of May 16, 1968. The model has been used to investigate the effects of convective nonlinearities on the bay oscillations and also to determine the efficiency of the breakwater which was built to reduce the effects of tsunamis at Ofunato.

An Introduction to Tsunamis and Defense Works in the Sanriku Coastal Area

A booklet, distributed at the International Tsunami Symposium, discusses the defense works that have been taken place in tsunami prevention in the areas of Ofunato, Ryori, Okkirai, Toni, Kamaishi, Funakoshi, Yamada, Miyako, Taro, and Omoto in the Sanriku Coastal area of Japan.

PACIFIC TSUNAMI WARNING CENTER

New Geophysicist at PTWC - Richard Sillcox

Richard Sillcox assumed the Geophysicist position at PTWC on July 1, 1981. Sillcox received an AB in Physics from Duke University in 1969 and a MS in Physical Oceanography from University of Washington, Seattle, in June of this year. Prior to coming to PTWC, Sillcox was an Oceanographer with NOAA's Pacific Marine Environmental Laboratory in Seattle, Washington.

Seismic Summary (April 1, 1981 to Press Time)

<u>Event No.</u>	<u>Event</u>	<u>Location</u>	<u>Action Taken</u>
1981-8 (PTWC)	Apr 24 2150 (UT) 6.7	Espiritu Santo Island 14.0 S 166.0 E	Press Release
1981-9 (PTWC)	Apr 27 1818 (UT) 6.5	South of Tasmania 55.6 S 148.1 E	-
1981-10 (PTWC)	May 25 0525 (UT) 7.3	Auckland Islands, South of New Zealand 49.3 S 164.7 E	Press Release
1981-11 (PTWC)	Jul 6 0308 (UT) 6.7	Fiji Basin, East of New Caledonia 23.4 S 171.4 E	Press Release
1981-12 (PTWC)	Jul 15 0759 (UT) 6.6	Central Vanuatu 17.0 S 167.8 E	Press Release
1981-13 (PTWC)	Jul 28 1723 (UT) 7.3	Eastern Iran 33.4 N 57.3 E	Press Release

CALL FOR PAPER - TSUNAMI SOCIETY

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